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MILKY DISEASE

. . . for control of Japanese beetle grubs

U.S. Department of Agriculture Leaflet No. 500

MILKY DISEASE

for control of Japanese beetle grubs

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The Japanese beetle[1] is a destructive pest that occurs in about one-sixth of the area of the United States. Its infestation extends along the east coast and spreads westward. It attacks more than 275 kinds of trees, shrubs, turf, field crops, and garden plants, and causes many millions of dollars' worth of damage every year.

The adult beetle feeds on fruit, flowers, and foliage. The immature stage, the grub, feeds on roots and underground stems of plants, particularly grasses; when numerous, it causes serious damage to lawns and other turf areas.

Both adults and grubs can be controlled by the use of chemical insecticides. The grubs, however, are subject to several diseases. The most important is known as milky disease. It kills grubs after causing their normally clear blood to become milky in appearance.

Milky disease was discovered in 1933 in central New Jersey and was promptly recognized as a major natural enemy of the grubs. Methods for its production and use were developed.

Preparations containing spores of the bacteria that cause milky disease are available commercially. When applied to infested turf, they destroy Japanese beetle grubs.

NATURE OF MILKY DISEASE

Bacteria.—Two kinds of bacteria are known to cause milky disease in grubs.[2] They attack only members of the white grub family. More than 40 species of white grubs are subject to their infection, but the Japanese beetle grub is probably the most extensively affected. Milky-disease bacteria do not infect other insects, earthworms, birds, warm-blooded animals, humans, or plants.

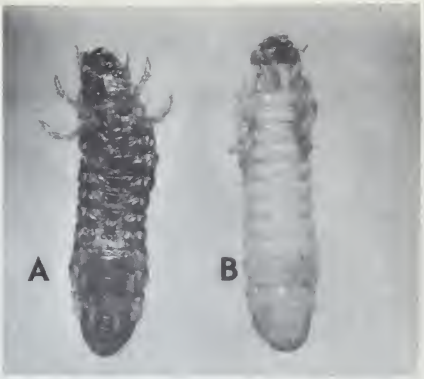
Spores.—The resting stage of bacteria that cause milky disease, the spores, occurs in the soil. It also occurs in the bodies of grubs that

[1] *Popillia japonica.*

[2] *Bacillus popilliae* and *B. lentimorbus.*

BN—13368—X

Japanese beetle grub, much enlarged.



DN—218

Grubs: A, normal; B, diseased.

have been infected by the bacteria. The spores are very tiny; 5,000 placed end to end would make a row about an inch long.

When spores are applied to the soil in a dust mixture, they are remarkably resistant to dryness or excessive moisture, extreme temperatures, and other adverse conditions. They are unharmed after passing through the digestive tracts of birds and small animals that eat the grubs they infect. They remain alive in the soil for many years, and infect successive generations of grubs.

When spores are exposed directly to ultraviolet light or sunlight, their potency is reduced; but when mixed with a material such as talc or chalk, many spores are protected from the effect of light.

How milky disease works.— Beetle grubs burrow through the soil, feeding on roots and other vegetable matter; they take in the spores along with particles of soil and other material. The spores germinate inside the grubs, and multiply rapidly in their blood. When the bacteria become very numerous in the blood they again form spores, completing the bacterial cycle.

Some diseases kill insects in a few hours or days, but the milky disease works slowly. Infected grubs may live for months after their blood has become loaded with spores, particularly if temperatures are low. Sometimes, grubs that become infected late in fall will live until spring. After spores appear in the blood, grubs usually do not develop further; they eventually die.

How milky disease affects adult

J—266—B

Grubs under turf.

beetle populations.—Application of spore dust to lawns and parks is most effective in reducing adult beetle populations when it is done on a community basis. When all land in a community is thoroughly inoculated with milky-disease bacteria, it usually is not possible for large numbers of grubs to survive and transform into adults.

Treatment of a single homesite may protect turf from injury by grubs. It will not protect against adult beetles that may fly in from gardens, orchards, untreated turf, or other untreated areas.[3]

AVAILABILITY OF SPORE DUST

Milky-disease spore dust is produced commercially by manufacturers who collect grubs and inoculate them with the disease. Infected grubs are incorporated in dust mixtures that homeowners and others can distribute over turf areas to kill healthy grubs.

The Department of Agriculture does not have spore dust for distribution to private individuals or organizations. The dust is sold by many garden supply stores. If your local dealer does not handle it, consult your county agent to learn the nearest source of supply.

APPLYING SPORE DUST

Spore dust is recommended for use when the grub population ranges from 1 to 10 per square foot of turf. The disease will not become established and spread unless some grubs are present. The more numerous the grubs are in the soil, the sooner the bacteria may become established.

The dust is recommended for application only to permanent turf. Grub infestation in cultivated land is usually light; cultural operations tend to bury or scatter spores before the disease can become established.

One treatment of infested turf should be sufficient. The bacteria multiply in successive generations of infected grubs.

Apply the dust any time when the ground is not frozen; it is particularly effective in spring or fall.

One application method is to place the dust in spots at intervals of 10 feet, in rows 10 feet apart. Apply 2 grams (approximately 1 level teaspoonful) at each spot. This is at the rate of 2 pounds per acre. A hand-operated corn planter that has a rotary disk adjusted to deliver 2 grams of dust each time it is tripped, is a convenient tool for spot-treating areas of an acre or more. If you wish the disease to become effective more rapidly, dis-

[3] Foliage and fruit of most plants may be protected from Japanese beetles by spraying or dusting them with DDT, methoxychlor, malathion, parathion, or rotenone. Information on the use of these insecticides is given in USDA Farmers' Bulletin 2151, "The Japanese Beetle: How To Control It."

J—3699

A hand corn planter is suitable for treating areas of moderate size.

pense the dust in a grid pattern at 5-foot intervals (8 pounds per acre) or at 3-foot intervals (21 pounds per acre).

Another method is to broadcast the dust by hand, or distribute it with a fertilizer spreader. If you use this method, do not apply less than 20 pounds of dust per acre; mix it with several times its volume of soil, sand, or commercial fertilizer.

Time required for results.—The time required for milky disease to become established at a site depends on several conditions, including the rate and manner of application, the size of the grub population, and the temperature of the soil.

When spot treatment is used, the bacteria are spread by movement of infected grubs through the soil, by birds and animals that feed on infected grubs, and by natural or artificial movement of topsoil containing spores. Several years may elapse before the bacteria have spread over all of a lawn or field; during this time, grubs may cause severe damage in spots where spores are not present.

The effectiveness of milky-disease bacteria is influenced by temperature. The organisms develop most rapidly at temperatures between 60° and 97° F. In parts of the country where soil temperature remains above 70° for several months, a considerable buildup of the disease may occur in 1 year; in colder parts, it may take 3 to 5 years.

When milky-disease bacteria become established at a site, they spread naturally to adjoining, untreated areas.

Spore dust compared with chemical insecticide.—Spore dust kills grubs, and thereby prevents beetles from developing. Chemical in-

secticides kill both grubs and beetles.

Do not apply spore dust and chemical insecticide to the same turf; insecticide will keep the grub population at a very low level, and will prevent buildup of milky-disease bacteria. An exception is when spore dust has been applied and its control is found to be inadequate; then the need for a chemical insecticide is indicated.

Do not apply spore dust when more than 10 grubs per square foot are present and are damaging the turf by their feeding; milky-disease bacteria will not build up rapidly enough to prevent further injury. Chemical treatment is needed.[4]

If you wish to use both spore dust and chemical insecticide on your premises, you should treat areas separately. For example, you may wish to treat the backyard with spore dust, and the front lawn with insecticide.

On a golf course, insecticide may be applied to the greens and fairways, and spore dust to the other areas.

DISTRIBUTION OF MILKY DISEASE

During the period 1939–53, the U.S. Department of Agriculture in cooperation with State and other Federal agencies conducted an extensive program to colonize milky-disease bacteria in areas where the organism did not occur naturally. When the program was discontinued, almost 229,000 pounds of spore dust had been applied at 160,000 sites in 14 eastern States and the District of Columbia. In addition, 15,500 pounds had been used in treating properties owned or maintained by the Federal Government. Damage by the Japanese beetle has been greatly reduced where the milky disease was thoroughly established through this program.

Today, many acres have been treated by private individuals with spore dust produced by commercial concerns. Also, milky-disease bacteria are spreading naturally, and are giving control without the aid of man. In many areas, damage by the beetle has become economically unimportant. Even where the milky disease is well established, however, there have been localized, upsurges of the insect—the reason for which is not yet undersood.

[4] Information on the use of chemical insecticides to protect turf from Japanese beetle grubs is given in USDA Farmers' Bulletin 2151, "The Japanese Beetle: How To Control It."

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